PROC. ENTOMOL. SOC. WASH.
108(1), 2006, pp. 24–34

NEW SCORPIONFLIES (MECOPTERA: PANORPIDAE) FROM JALISCO, MICHOACÁN, AND OAXACA, MEXICO

WESLEY BICHA

121 Old Batley Road, Oliver Springs, TN 37840, U.S.A. (e-mail: bichawj@ornl.gov)

Abstract.—Four **new species**, ***Panorpa dividilacinia, P. umbricola, P. mixteca,*** and ***P. insigna,*** are described and illustrated from the Mexican states of Jalisco, Michoacán, and Oaxaca. Habitat details are provided. These additions bring the total number of known species of southwestern and south central Mexican *Panorpa* to 16 and the total of Mexican species to 28.

Key Words: new species, scorpionfly, Mecoptera, *Panorpa,* Mexico

There are currently 12 species of *Panorpa* known from southwestern and south central Mexico. These scorpionflies are generally found in moist, shady areas above 1200 m in elevation in the mountainous areas of Mexico. In the nineteenth century *P. terminata* Klug, which has since been found from a number of locations in the Cordellia Volcanica, was described. In the early twentieth century *P. immaculata* Esben-Petersen, found throughout the Sierra Madre del Sur, was added. During the past 45 years Dr. George Byers has greatly expanded our knowledge and the number of known species from this region, adding *P. penicillata* Byers from the Sierra Madre Occidental, *P. azteca* Byers, *P. serta* Byers, *P. apiculata* Byers, and *P. truncata* Byers from the Cordellia Volcanica, and *P. bimacula* Byers, *P. gladiata* Byers, *P. acicularis* Byers, *P. aculeata* Byers, and *P. luteola* Byers from the Sierra Madre del Sur. It is possible that *P. punctata* Klug occurs in this region of Mexico. The type location of the single female was unstated and no additional specimens have been located in the century since its description.

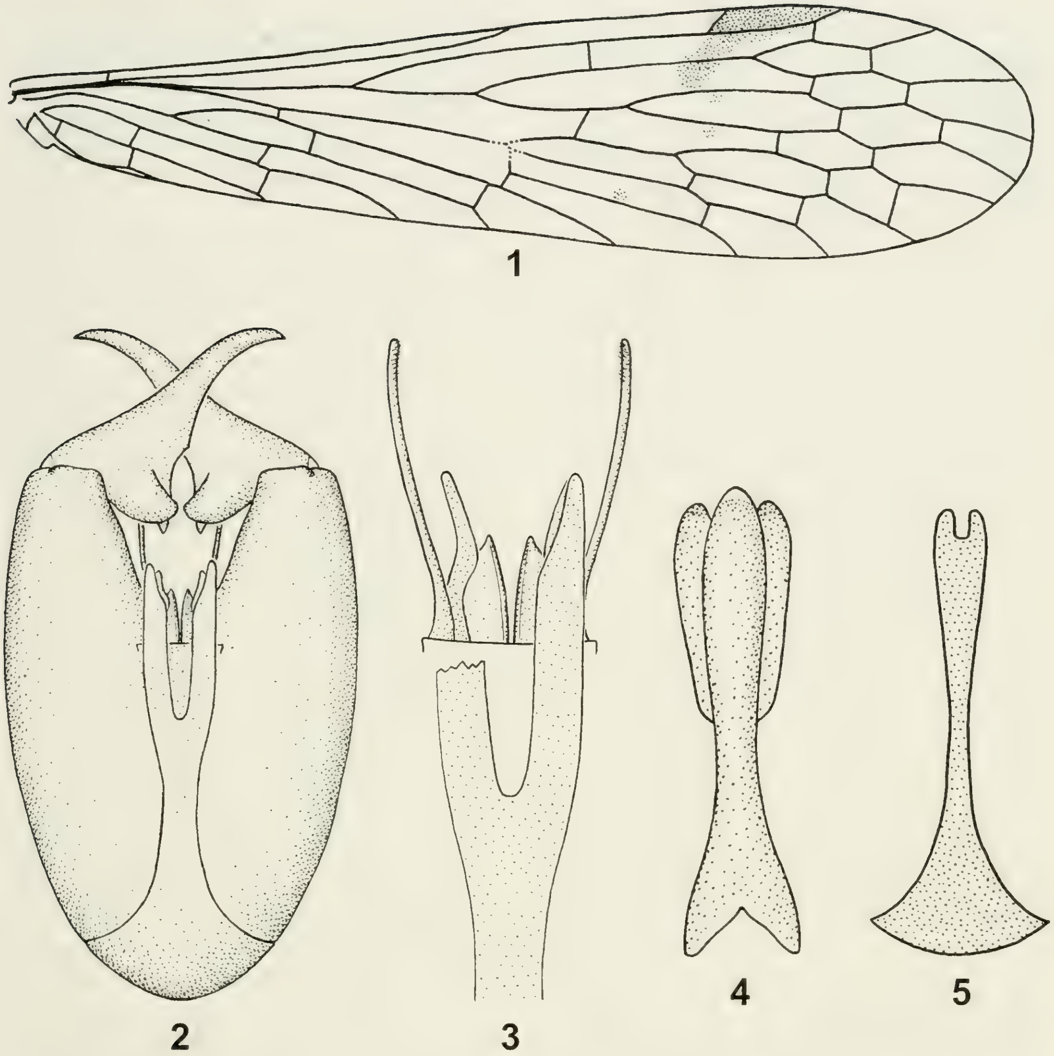
Extensive field work in this region throughout the past several decades has resulted in an additional four species being discovered which are described in this paper.

Panorpa dividilacinia Bicha, new species
(Figs. 1–4)

Description.—Based on 26 ♂, 23 ♀, pinned from alcohol.

Head: Dorsum brown; glossy black cross band above antennal bases, extending along inner margin of eyes to posterior margin of vertex. Rostrum yellowish brown, with two longitudinal bands in some individuals; genae pale yellow. Labrum and maxillary palps brown. Antennal scape pale yellowish brown, pedicel dark brown to black, flagellum black, with approximately 40 flagellomeres.

Thorax: Pronotum black, pale yellowish along posterior margin; 9–11 black setae at each side on anterior margin. Mesonotum and metanotum black with yellowish white median band, with numerous short, black hairs directed caudad. Scutellum yellowish-white. Pleural surfaces, coxae and mera sordid white to pale yellow with numerous short, dark setae on anterior coxa and on mesothoraxic coxa and episternum; sparse, pale setae on metathorax, most numerous



Figs. 1–5. 1–4, *Panorpa dividilacinia,* paratypes. 1, Male right forewing. 2, Male genital bulb, ventral aspect. 3, Hypovalves and aedeagus, ventral aspect, left hypovalve removed for clarity, slightly enlarged scale. 4, Female genital plate, ventral aspect (posterior end at top). 5, *Panorpa immaculata,* hypovalve, ventral aspect.

on coxa; small black spot at each end of mesepimeron and metepimeron. Femora and tibiae sordid white with numerous short, apically-directed black hairs and a lesser number of black setae. Tibiae with two brown spines. Tarsi sordid white with numerous apically-directed golden hairs.

Wings (Fig. 1) faintly tinged with grey brown, slightly iridescent, markings brown, veins brown, stigma dark yellowish, thyridium at first fork of M white; pterostigmal band reduced to triangle extending from C to R_4, sometimes broken with a small spot posterior to R_5; some individuals with faint, small basal spot at Cu_1. Wing markings typically more pronounced in females.

Male abdomen: Terga 2–5 glossy black; sterna 2–3 sordid white; sterna 4–5 grading from brown to black; segment 6 glossy black, long, cylindrical, narrowed posteriorly, without anal horn; segments 7–8 short, yellowish orange. Tergum 3 posterior margin with notal organ slightly pronounced above; tergum 4 anterior margin with small protuberance. Hypovalves (Fig. 2) of sternum 9 slender, divergent from narrow prolongation of sternum, parallel, extending half way between ventral fusion of basi styles and bases of diststyles, apices truncated at 60° on mesal edge. Tergum 9 narrowing apically, extending an additional one-third beyond cerci to just beyond bases of diststyles, apically emarginate. Cerci darker apically. Basistyles joined ventrally. Diststyles outer margin slightly concave until acute tip; with a large, cuplike basal lobe prolonged ventromesally; dorsomesal edge of basal cup with triangular tooth. Aedeagus (Fig. 3) with straight, slender, single-branched ventral parameres extending one-third length beyond bases of diststyles; dorsal parameres, long, straight, dorsally flattened, extending just beyond bases of diststyles. Dorsal valves small, rounded, dark; ventral valves cone-shaped.

Female abdomen: Terga and sterna 2–7 dark brown to black; 8–9 sordid white; cerci brown. Genital plate (Fig. 4) elongate; distal plate yellowish, elongate, with slight apical emargination; basal plate absent; spermathecal apodemes thick, dark brown, extending into and filling apical emargination of distal plate, slightly divergent basally with area between partially sclerotized, free length one-half length of plate.

Measurements: Holotype body length approximately 12 mm. Holotype fore wing length, 12.8 mm.

Material examined.—Holotype ♂, allotype ♀, and 25 ♂ 23 ♀ paratypes, collected from La Polvilla (19°38′N, 100°58′W), 2,135 m elevation, Michoacán, Mexico, July 29, 2001. One ♂ paratype, 10 km N of Cheran (19°44′N, 102°1′W) 2,178 m elevation, Michoacán, Mexico, August 6, 2001. Holotype and allotype deposited in the Florida State Collection of Arthropods (FSCA), Gainesville, Florida; additional paratypes in the California Academy of Sciences (CAS), San Francisco, California, Illinois Natural History Survey (INHS), Champaign, Illinois, the Snow Entomological Museum (SEM), University of Kansas, Lawrence, Kansas, Texas A & M University (TAMU), College Station, Texas, National Museum of Natural History (USNM), Washington, D.C., and collection of the author.

Biology.—*Panorpa dividilacinia* was found to be abundant, along with the slightly less numerous *P. azteca,* on the top surfaces of lush herbaceous vegetation in the open shade of the pine forested slopes of the Cordellia Volcanica. Both were observed to be active from approximately 9:30 a.m. until 4:30 p.m., in spite of overcast sky and a light rain. *Panorpa serta* was not observed to coexist with these insects but was hidden vertically on plant stems among broad-leafed herbaceous vegetation in the dense shade of hardwood forest several miles away at 6880 ft elevation. Unlike most *Panorpa* from the eastern United States, but like many *Panorpa* from Mexico, these three species hold their wings together rooflike over their abdomens.

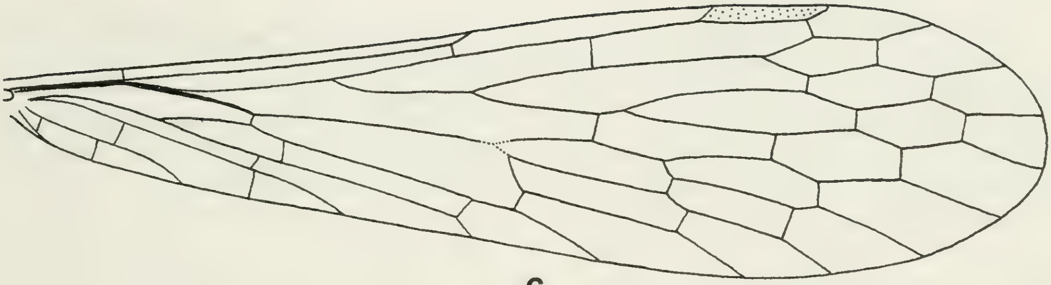
Diagnosis.—*Panorpa dividilacinia* is most similar to *P. immaculata* in some details of the male genitalia, but superficially resembles *P. azteca, P. gladiata,* and *P. apiculata* with their generally unmarked wings. However, males of *P. dividilacinia* may be readily differentiated from these species by the unique shape of the hypovalves. Further, the basistyles ventral area of fusion is narrowly indented posteromedially in *P. azteca* (Byers 1958, fig. 9) and *P. apiculata* (Byers 2001, fig. 5), but not *P. dividilacinia.* In the field the insect may be told from *P. azteca,* with which it coexists, by the glossy black markings on the head.

Etymology.—The name is based on a combination of *divido,* Latin for divided and *lacinia,* Latin for flap. It is the divided flaplike hypovalves of this species that differentiates it from *P. immaculata* (Fig. 5), the species it most resembles.

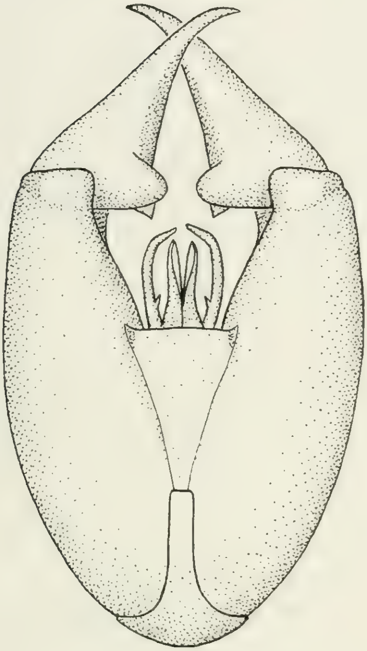
Panorpa mixteca Bicha, new species

(Figs. 6–8)

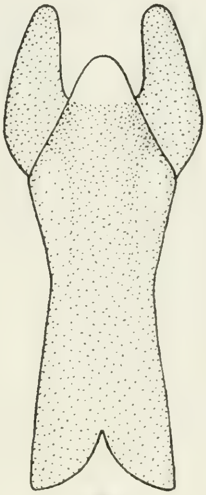
Description.—Based on 14 ♂, 10 ♀, pinned from alcohol.



6



7



8

Figs. 6–8. *Panorpa mixteca,* paratypes. 6, Male right forewing. 7, Male genital bulb, ventral aspect. 8, Female genital plate, ventral aspect (posterior end at top).

Head: Dorsum glossy black. Rostrum yellowish brown; genae yellowish brown. Labrum and maxillary palps brown. Antennal scape brown, pedicel dark brown to black, flagellum black, with 40–41 flagellomeres.

Thorax: Pronotum black, pale yellowish along posterior margin; 8–14 black setae at each side on anterior margin. Mesonotum and metanotum black with yellowish white median band, with numerous short, black hairs directed caudad. Scutellum yellowish -white. Pleural surfaces, coxae and mera sordid white, with numerous short, dark setae on anterior coxa and on mesothoraxic coxa and episternum; sparse, pale setae on metathorax, most numerous on coxa; small black spot at each end of mesepimeron and metepimeron. Femora and tibiae sordid white with numerous short, apically-directed, black hairs and a lesser number of black setae. Tibiae with two brown spines. Tarsi sordid white with numerous apically-directed golden, and dark brown hairs.

Wings (Fig. 6) faintly tinged with yellow, slightly iridescent, immaculate in both sexes, veins pale brown, stigma pale yellowish, thyridium at first fork of M white.

Male abdomen: Terga 2–5 dark brown to black; sterna 2–5 sordid white; segment 6 black with some lateral grading to yellowish brown posteriorly, long, cylindrical, narrowed posteriorly, without anal horn; segments 7–8 short, yellowish orange. Posterior edge of tergum 3 with notal organ; tergum 4 with small protuberance on anterior edge. Narrow prolongation of sternum 9, undivided, extremely short, extending only half length of ventral fusion of basistyles (Fig. 7). Tergum 9 narrowing apically with apical emargination; cerci brown. Basistyles broadly joined ventrally. Dististyles with outer margin slightly concave until curved acute tip; with large, cuplike basal lobe prolonged ventromesally; dorsomesal edge of basal cup with angular tooth. Dorsal parameres cylindrical, straight, extending to bases of dististyles; ventral parameres unbranched; apices slightly curved mesad, aculeate, with one mesal "barb" on apical one-third; sometimes extending slightly beyond the bases of dististyles into basal cup. Dorsal valves small; ventral valves conspicuous, conical, laterally compressed, apices slightly curved ventrally, nearly reaching base of dististyles.

Female abdomen: Terga and sterna 2–7 dark brown to black; 8–9 sordid white; cerci brown. Genital plate (Fig. 8) elongate, narrow; distal plate parallel, apex with deep emargination forming two thin lateral lobes; basal plate absent; spermathecal apodemes extending into apical emargination of distal plate, slightly divergent basally with area between partially sclerotized, free length one-half of genital plate.

Measurements: Holotype: body length approximately 12 mm fore wing length 11.5 mm.

Material examined.—Holotype ♂, allotype ♀, and 13 ♂ 9 ♀ paratypes collected 2 km SE of Laguna de Guadalupe (17°11′N 97°20′W), 2445 m elevation, Oaxaca, Mexico, July 6, 1990; 4 ♂ and 4 ♀ paratypes, same locality, July 25, 2003. Holotype and allotype deposited in the SEM, and 13 ♂ 9 ♀ paratypes in the CAS, INHS, USNM, and collection of the author.

Biology.—*Panorpa mixteca* was observed sitting with wings held together rooflike over the abdomens horizontally on the top surfaces of lush herbaceous vegetation in the open shade of the cloud-shrouded, pine-forested slopes of the Sierra Madre del Sur. It coexists with the slightly larger *P. immaculata* in nearly equal numbers in late July.

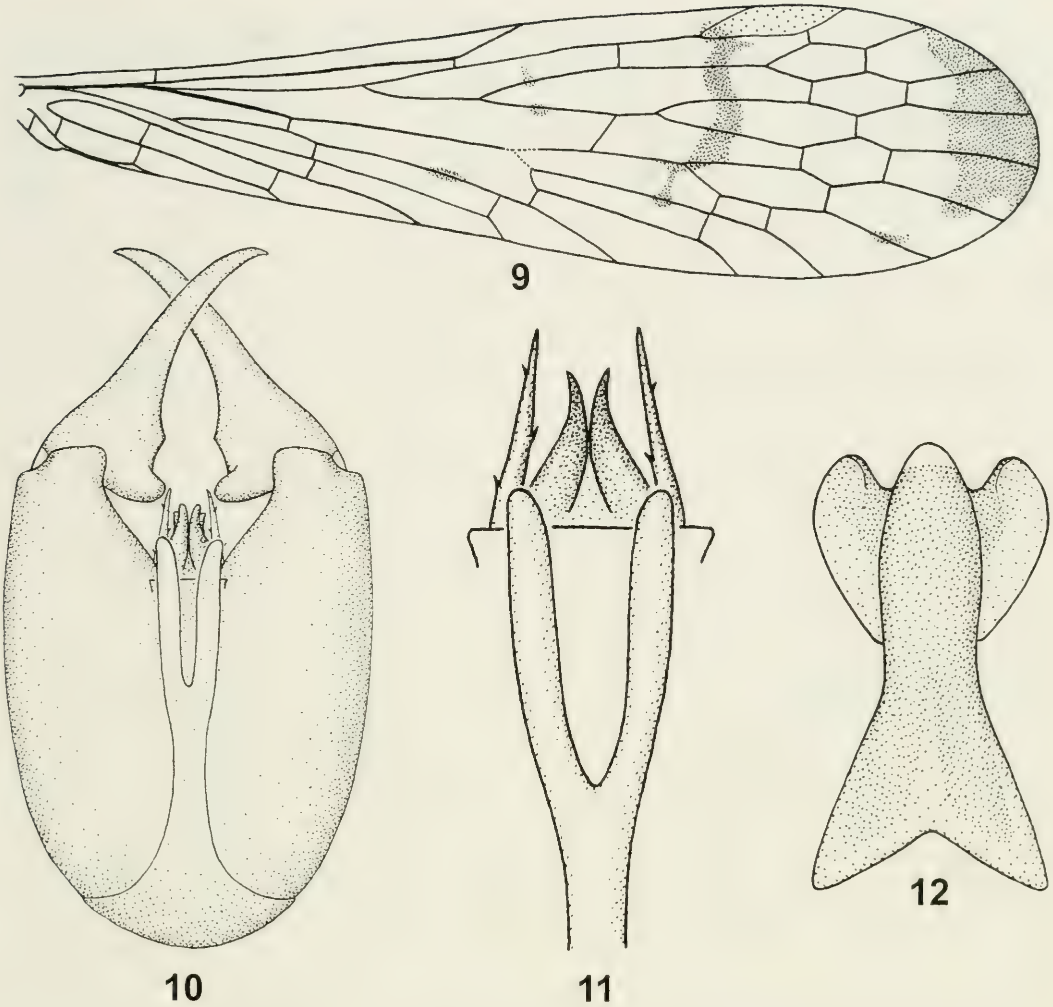
Diagnosis.—*Panorpa mixteca* is similar to *P. immaculata, P. serta,* and *P. dividalacinia* in general appearance and some details of the male genitalia. However, males *of P. mixteca* may be readily differentiated by the short, thin, undivided "hypovalve" and the single-barbed ventral parameres. The hypovalves of *P. immaculata* (Fig. 5) and *P. serta* (Byers 1996, fig. 57) reach beyond the fusion of the basistyles and are apically separated, while the "hypovalve" of *P. mixteca* barely extends two-thirds the distance and is apically truncate. It is the single, short, undivided "hypovalve" of this species that differentiates it from all other known North American species (*P. truncata* Byers, also from Mexico, is unique in lacking hypovalves altogether). The only other known *Panorpa* with a short, undivided "hypovalve" is *P. indivisa* Martynova from the Russian Far East. The ventral parameres of *P. immaculata* and *P. dividilacinia* are subuliferate with no barb as with *P. mixteca.*

Etymology.—The species is named for the indigenous people, the Mixtec or "people of the clouds," who inhabit the general area where this species was discovered. Living over 2400 m in elevation, *P. mixteca* is truly a scorpionfly of the clouds.

Panorpa umbricola Bicha, new species
(Figs. 9–12)

Description.—Based on 4 ♂, 4 ♀, pinned from alcohol.

Head: Dorsum pale yellowish brown; glossy black ocellar triangle. Rostrum yellowish brown, with two darker longitudinal



Figs. 9–12. *Panorpa umbricola,* paratypes. 9, Male right forewing. 10, Male genital bulb, ventral aspect. 11, Hypovalves and aedeagus, ventral aspect, enlarged. 12, Female genital plate, ventral aspect (posterior end at top).

bands in some individuals; genae pale yellow. Labrum and maxillary palps brown. Antennal scape pale yellowish, pedicel sordid white basally grading to dark brown apically, flagellum dark brown, with 40–42 flagellomeres.

Thorax: Pronotum sordid white to pale yellowish brown with brown lateral band; 5–7 large black setae at each side on anterior margin. Mesonotum and metanotum sordid white to pale yellowish brown with brown lateral band. Scutellum white. Pleural surfaces, coxae and mera sordid white with numerous short, dark setae on anterior coxa and on mesothoraxic coxa and episternum; sparse, golden setae on metathorax, most numerous on coxa; small black spot at each end of mesepimeron and metepimeron. Femora and tibiae sordid white with numerous short, apically-directed golden hairs and a lesser number of dark brown setae. Tibiae with two brown spines. Tarsi sordid white with numerous apically-directed golden to dark brown hairs.

Wings (Fig. 9) strongly tinged with yellow, markings brown, veins dark brown, crossveins white, stigma dark yellowish, thyridium at first fork of M white; apical band extends from R_{2b} to halfway between M_1 and M_2; pterostigmal band thin, long, extending from C to M_1; small band along Cu_1 in some specimens. Wing markings more pronounced in females.

Male abdomen: Terga 2–5 pale yellowish brown; sterna 2–3 and plural areas sordid white; segment 6 pale orange, long, cylindrical, narrowed posteriorly, without anal horn; segments 7–8 short, pale orange. Posterior edge of tergum 3 with notal organ; tergum 4 with small protuberance on anterior edge. Base of hypovalves (Fig. 10) of sternum 9 slender; hypovalves divergent, extending one-half to three-fourths of way between ventral fusion of basistyles and bases of dististyles. Tergum 9 narrowing apically with shallow apical emargination. Basistyles broadly joined ventrally. Dististyles with outer margin slightly concave until curved, acute tip; with cup-like basal lobe prolonged ventromesally. Dorsal parameres cylindrical, straight, extending to bases of the dististyles; ventral parameres (Fig. 11) unbranched, long, straight, extending to bases of dististyles; apical one-third with a few, fine, thorn-like setae. Dorsal valves small; ventral valves forming cone.

Female abdomen: Terga 2–8 brown to dark brown; 9 yellowish brown; sterna 2–8 pale brown to brown; segment 10 brown; cerci black. Genital plate (Fig. 12) long, narrow; distal plate parallel, with deep emargination forming two thin lateral lobes; basal plate absent; spermathecal apodemes extending well into apical emargination of distal plate, slightly divergent basally, free length one-fourth of plate.

Measurements: Holotype body length, approximately 12 mm. Holotype fore wing 12 mm.

Material examined.—Holotype ♂, allotype female, and 3 ♂ 4 female paratypes, collected 23.8 km by road S of Mazamitla (measured from church at city square) on highway 110 (19°48′N, 103°6′W), 1,390 m elevation, Jalisco, Mexico, August 5, 2003. Holotype and allotype deposited in the USNM, paratypes in collection of the author.

Biology.—Individuals of *P. umbricola* were found with some difficulty in deep shade among grasses and dense herbaceous vegetation growing on a steep, wooded slope. The area was predominantly hardwood forest. Individuals were observed with their wings held tightly together over their backs while perched vertically among plant stems. The distinctive habitat and stance of *P. umbricola* are nearly identical to those of *P. terminata* and *P. serta.* Perhaps coincidentally, each of these three species has apical bands present on the wings. *Panorpa terminata* has been found at a number of sites in Morelos and *P. serta* from eastern Michoacán. *Panorpa umbricola* appears to be the western member of this species group and one of the westernmost of the "small" *Panorpa* species in North America.

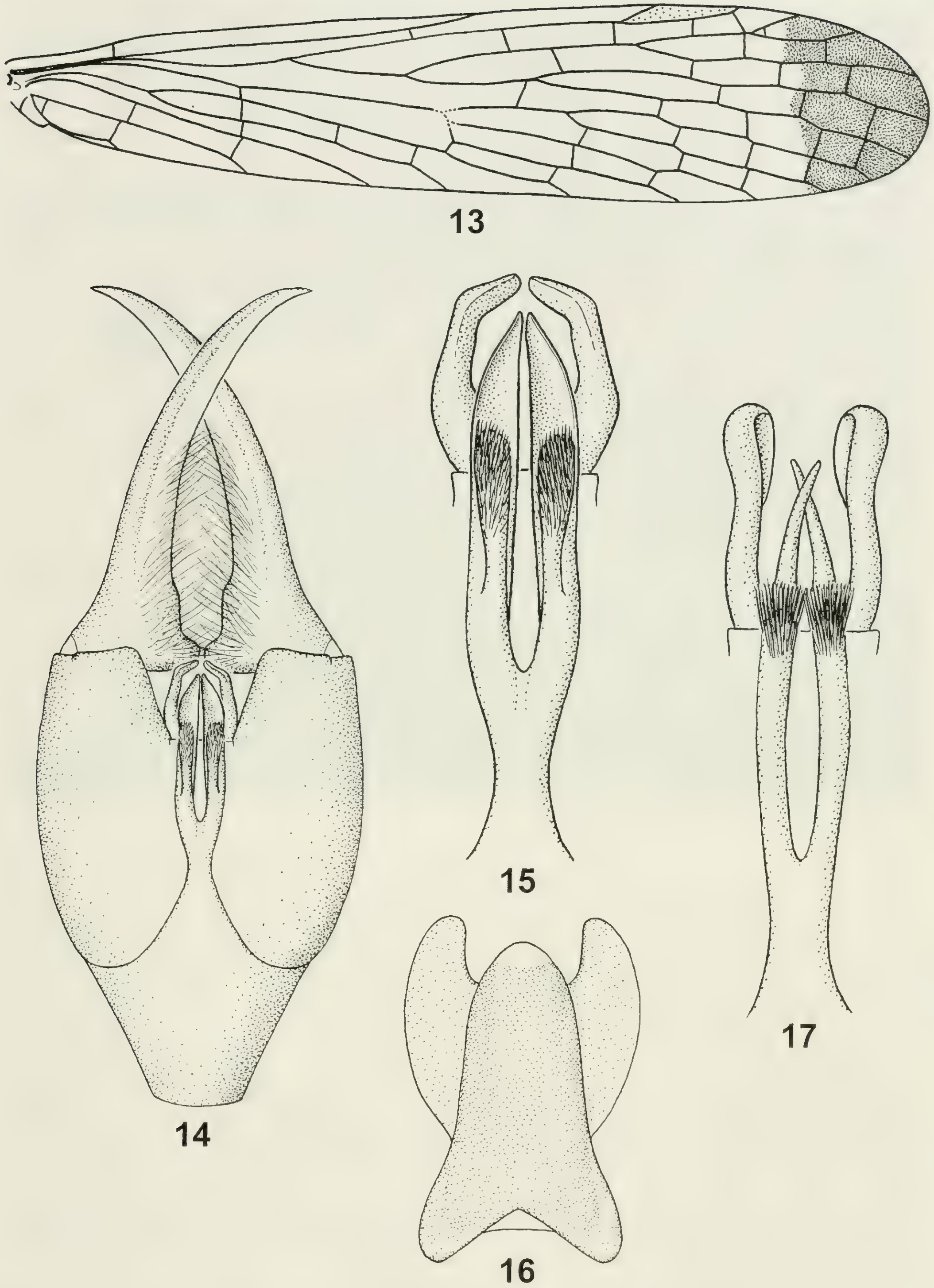
Diagnosis.—*Panorpa umbricola* may be differentiated from all other known Mexican scorpionflies by a combination of the shape of the hypovalves and ventral parameres in the male and the shape of the genital plate and wing markings in the female. It may be told readily from the other two species it is biologically most similar to, *P. serta* and *P. terminata,* by the male hypovalves not being fused and being of constant width throughout their length. In the field, it may be differentiated from other scorpionflies of southwestern Mexico by the vertical resting position, small size, and unique, multiple band wing markings.

Etymology.—The species name is based on a combination of *umbra,* Latin for shade and *incola,* Latin for dweller, and refers to the deep shade dwelling nature of this insect.

Panorpa insigna Bicha, new species

(Figs. 13–16, 18)

Description.—based on 9 ♂, 11 ♀, pinned from alcohol.



Figs. 13–17. 13–16, *Panorpa insigna,* paratypes. 13, Male right forewing. 14, Male genital bulb, ventral aspect. 15, Hypovalve and aedeagus, ventral aspect, slightly enlarged scale. 16, Female genital plate, ventral aspect (posterior end at top). 17, *Panorpa penicillata,* hypovalve and aedeagus, ventral aspect.

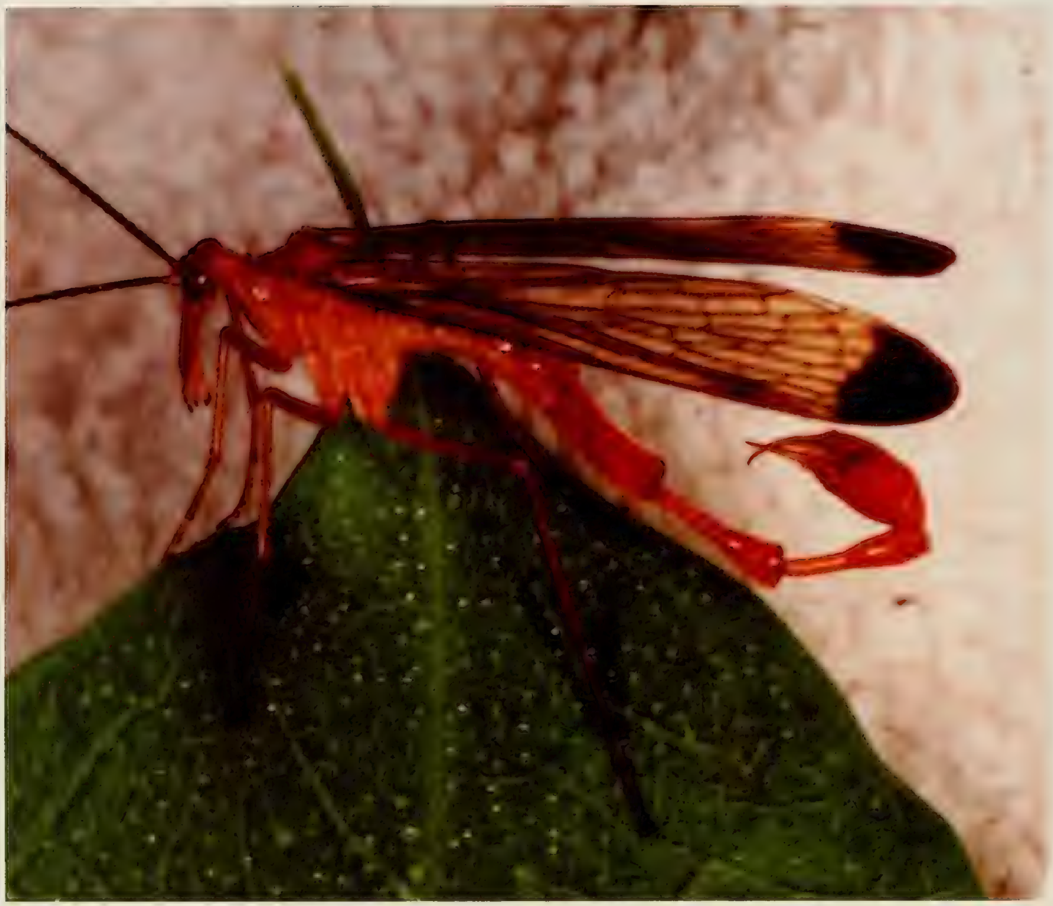


Fig. 18. Photo of *Panorpa insigna* male paratype.

Head: Dorsum orange to brownish orange; ocelli margined with brown. Rostrum dark brownish orange; genae brownish orange. Labrum and maxillary palps brown. Antennal scape brownish orange, pedicel dark brown to black, flagellum black, with 40 flagellomeres.

Thorax: Pronotum brownish orange; 9–11 black setae at each side on anterior margin. Mesonotum and metanotum brownish orange, with numerous short, black hairs directed caudad. Scutellum brownish orange. Pleural surfaces, coxae and mera pale brownish orange with numerous short, golden setae on anterior coxa and on mesothoracic coxa and episternum; sparse, golden setae on metathorax, most numerous on coxa; small black spot at each end of mesepimeron and metepimeron. Femora and tibiae yellowish brown with numerous short, apically-directed golden hairs and tibiae with a lesser number of black setae. Tibiae with two brown spines. Tarsi reddish brown with numerous apically-directed golden hairs.

Wings (Fig. 13) faintly tinged with brown, markings dark brown, veins brown, stigma yellowish orange, thyridium at first fork of M white; pterostigmal band absent in male, reduced to small triangle extending from C to R_2 in female; apical band broad, entire. Wing markings absent altogether in some males.

Male abdomen: Terga and sterna 2–5 brownish orange; segment 6 orange, long, cylindrical, slightly curved dorsad, without anal horn; segments 7–8 orange, long, each segment tapered with reduced anterior diameter. Posterior edge of tergum 3 with notal organ; tergum 4 with small protuberance on anterior edge. Hypovalves (Fig. 14) of sternum 9 divergent from narrow prolongation of sternum, ventrally concave, subulate, extending slightly beyond bases of dististyles, each with ventral penicillate process, extending half way between ventral fusion of basistyles and bases of dististyles. Tergum 9 narrowing apically, with shallow apical emargination. Basistyles broadly joined ventrally; apical mesal margin with long, fine setae (omitted for clarity in Fig. 14) sometimes obscuring details within genital bulb. Dististyles long, slender, with curved, acute tip; mesal margin with long, fine setae; with slight, cuplike basal lobe. Dorsal parameres dorsoventrally flattened, rounded apically, extending nearly to bases of dististyles; ventral parameres (Fig. 15) broad, laterally flattened, apices curved mesad, unbranched, without "barbs," extending to bases of dististyles. Dorsal valves short, rounded; ventral valves broad at base, conical, extending nearly to bases of dististyles.

Female abdomen: Terga and sterna brownish orange. Genital plate (Fig. 16) broad; distal genital plate composed of two thick, membranous arms curved dorsally; basal plate absent; spermathecal apodemes dark brown, short, thick.

Measurements: Holotype body length, approximately 24 mm. Holotype fore wing 16.5 mm.

Material examined.—Holotype ♂, allotype ♀, and 4 ♂ 2 ♀ paratypes, from Puerto los Mazos (19°42′N, 104°23′W) south of Autlan de Navarro, Jalisco, Mexico, 1,347 m elevation, August 3, 2001. Additional paratypes from same locality: 1 ♂ July 15, 1989; 1 ♂ and 3 ♀ August 3–7, 1992, 1 ♀ August 31, 1989, and 1 ♂ and 1 ♀ September 1, 1989. One ♂ and 1 ♀ paratypes from Mazamitla environs (19°56′N, 103°0′W) 2,085 m elevation, Jalisco, Mexico, August 25, 1989. One ♀ August 26, 1989, and 1 ♀ August 29, 1989 also from Mazamitla environs. Two ♂ and 1 ♀ with reduced body sizes, not designated as paratypes, from Volcan de Tequila, Jalisco, Mexico, August 22, 1993 in the CAS. Holotype, allotype, and paratype deposited in the USNM, and paratypes in the CAS and collection of the author.

Biology.—*Panorpa insigna* was observed sitting horizontally with wings held slightly apart in a "V" (Fig. 18) on the upper surfaces of lush herbaceous vegetation growing under the shade of broadleaved trees. Individuals were most often observed from 10 a.m. to 3 p.m., but never abundantly. Two other Mecoptera, *Bittacus banksi* Esben-Petersen and *B. occidentis* Walker, were common among tall grasses in neighboring open pine-land, but not found with *P. insigna.*

Diagnosis.—*Panorpa insigna* may be differentiated readily in the field from other scorpionflies in southwestern Mexico by its large size, and orange body coloration. The only other large *Panorpa,* currently known from southwestern Mexico, *P. truncata,* has a female of similar size and wing markings, but with a black head and thorax with white markings and a reddish brown abdomen. *Panorpa insigna* is similar to *P. penicillata* from approximately 500 km north in the Sierra Madre Occidental, in many respects, but differs specifically in the shape and size of the ventral parameres of the male genitalia and the wing markings. The ventral parameres of *P. penicillata* (Fig. 17) are longer, dorsoventrally compressed, with gouge-shaped apices. The apices of the ventral branch of the hypovalves of *P. penicillata* are truncate, while those of *P. insigna* are rounded.

Etymology.—The species name *insigna* is Latin for "striking." The large size, orange body coloration, and bold wing markings make this insect arguably one of the more striking scorpionflies known in North America.

ACKNOWLEDGMENTS

This paper is dedicated to Jim Bicha, my father, a lifelong schoolteacher, who took particular delight in encouraging curiosity about natural history in many students including myself. Also to my wife, Rosemary, who has endured 30 years of countless hours of waiting in less than comfortable circumstances "for just one more specimen to be found." I am indebted to Dr. Oliver Flint of the USNM, Dr. Norman Penny of the CAS, Dr. George Byers of the University of Kansas, and Dr. Edward Riley of TAMU for making specimens available for study. A special thanks to Arwin Provonsha of Purdue University for preparing illustrations and kindly reviewing the manuscript.

LITERATURE CITED

Byers., G. W. 1958. Descriptions and distributional records of American Mecoptera. Journal of the Kansas Entomological Society 31(3): 213–222.

———. 1996. Descriptions and distribution records of American Mecoptera. IV. The University of Kansas Science Bulletin 55(14): 519–547.

———. 2001. Four new Mecoptera from Mexico. Journal of the Kansas Entomological Society 73(2): 77–83.